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METHOD OF PREPARATION OF BITUMINOUS MIXTURES FOR TESTING

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Section D of this method. It is the responsibility of the user of this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

A. OVERVIEW

This method provides procedures for the preparation of bituminous mixtures for the following California Tests 303, 305, 307, 308, 310, 360, 366, and 367. The preparation procedures are for laboratory design mixtures, mixtures from the field for job control, and cores taken from the pavement for special studies.

The procedures are presented in two parts.

Part 1. Method of Preparation of Design Sets and Field Samples Prior to Compaction

Part 2. Method of Compacting Bituminous Materials for Swell, Stability, Moisture Vapor Susceptibility and Specific Gravity Tests

B. APPARATUS

1. Oven, capable of maintaining temperatures up to 200 ± 5˚C.

2. Oven, capable of maintaining a temperature of 60 ± 3˚C with provisions for free circulation of air throughout the oven.

3. One balance, 5-kg capacity, accurate to 1 g.

4. Sieves, Standard Sizes; 25 mm, 19 mm, 12.5 mm, 9.5 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 µm, 300 µm, 150 µm and 75 µm.

5. Sample splitter for aggregates – riffle type or equal.

6. Sample splitter for bituminous mixtures – rotating pan type (optional, see Figure 1).

7. Pans, approximately 250 mm diameter by 50 mm deep.

8. Pans, approximately 280 by 180 by 25 mm deep.

9. Pans, approximately 200 mm diameter by 45 mm deep.

10. Pans, approximately 305 mm diameter by 65 mm deep.

11. Thermometers, metal stems, with range of 35˚ to 260˚C.

12. Metal scoop, No. 3.

13. Beakers, 800 mL.

14. Hot plate, approximately 300 by 450 mm (if hand mixing is employed).

15. Trowels, small pointed.

16. Mechanical mixing machine (optional, see Figure 2).

17. Gloves, heat resistant.

C. MIXING

1. Mixing temperatures for mixtures containing paving grades of asphalt must be as follows:

Asphalt Designation	Aggregate Temperature
AR-1000	105 -120°C
AR-2000	120 -135°C
AR-4000	135 -150°C
AR-8000 and 16000	150 -165°C
Asphalt Rubber	150 -165°C

   The temperature of the asphalt at the time of mixing shall closely approximate the aggregate temperature, and in no instance exceed 190˚C.

2. Laboratory mixtures employing liquid asphalts are not governed by a mixing temperature. The liquid asphalt is added to the unheated aggregate at the minimum temperature that will permit ready pouring. The heat produced by the mixing machine, or hot plate if hand mixed, shall be sufficient to obtain a satisfactory mixture. Care shall be exercised not to overheat the mixture when using a hot plate for mixing.

3. An acceptable mechanical mixer is shown in Figure 2. It consists of steel bowls having hemispherical shaped bottoms, into which mechanically-driven stirring paddles are inserted. The paddle is shaped to fit the bottom of the bowl and is rotated at 3.1 ± 0.2 rad/s. Spring steel baffles supplement the paddle to aid in the agitation of the mixture.

   Preheat the aggregate and asphalt to the required mixing temperature prior to placing them in the mixer. Maintain the temperature during the mixing period with supplemental heat such as infrared lamps focused on the bottom of the mixing bowls. The length of mixing time varies with the type of aggregate. For instance, typical nonabsorptive aggregates require from 3 to 5 min mixing, while the more absorptive materials will require correspondingly longer periods of mixing.

D. SAFETY AND HEALTH

Personnel should use heat resistant gloves when working with hot materials. Use proper lifting techniques when handling bags of aggregate. Reasonable care should be exercised to avoid being burned by hot asphalt, aggregate or equipment.

Caution must be exercised in the operation of the compactor to prevent any object, other than the sample itself, from interceding between the compactor foot and the mold at any time while the ram is in motion. The clearance between the edge of the mold and the compactor foot is approximately 2 mm. The applied shearing force exerted could cause severe injury to body extremities or damage to equipment.

Caution should also be exercised in the operation of the testing machine to keep any objects other than the sample and testing apparatus clear of the loading head during the testing operation.

Prior to sampling, handling materials or testing, Caltrans personnel are required to read Sections 2.2, 4.1, 5.1 and 5.3 of Caltrans Laboratory Safety Manual and the Materials Safety Data Sheets (MSDS) for all materials used. Users of this method do so at their own risk.

PART 1: METHOD OF PREPARATION OF DESIGN SETS AND FIELD SAMPLES PRIOR TO COMPACTION

A. PREPARATION OF DESIGN SETS

1. Aggregate

   Refer to Item A.4 for special gradings requiring aggregates larger than 25 mm.

a. Aggregate samples from bins: These samples represent aggregate after all processing has been completed; i.e., just prior to addition of the bitumen. Thus, test these samples in as near the "as received" condition as possible.

   Separate the sample on the coarse aggregate sieves according to California Test 202. This separation should be done by hand if the aggregates are coated to prevent removal of these coatings. Use this grading and combine proportional amounts to make test samples of the various sieve size fractions.

b. Aggregate samples from stockpiles: Treat stockpile samples in the same manner as bin samples, provided there will be no further processing prior to the addition of bitumen.

c. Aggregate from pits or quarries. Pit or quarry preliminary samples are processed in various manners. Normally, instructions will be furnished by the sampler as to whether the oversize material is to be crushed or discarded. If crushing is to be employed, scalp the material on the designated sieve size and crush the retained material in such a manner that when blended back with its natural component, it will conform to the grading requirements for the project. Using procedures outlined in California Test 201, remove the coatings from the coated coarse aggregates and reduce soil lumps to passing the 4.75 mm. This is necessary in order that all the fine material will be accounted for in the sieve analysis and included in the sample when tested.

d. Use the sieve analysis of the sample or samples and design the mix to conform to the specified grading limits by blending or adjusting. Designing to a smooth grading curve approximating the middle of a specified range is desirable but not always essential. General practice is to produce the most uniform grading possible within the specification limits with the material on hand. Scalping out oversize, wasting portions, and combining are methods used to attain a desired grading. All final gradings shall be based upon a wash sieve analysis.

e. Samples of aggregate which are to conform to a specific grading requirement and fail to do so on certain sieve sizes can, in many cases, be adjusted to conform to the grading requirement by wasting certain portions of the sample. Any adjustment of grading shall be such that it can be duplicated under actual field conditions. Computations and examples for these adjustments are given in California Test 105.

f. The procedure for blending two or more individual samples in combination to produce a final grading conforming to certain requirements consists of calculations using various percentages of each in combination until a satisfactory grading is produced. As grading limits are based on materials of uniform specific gravity, a correction should be made to compensate for any differences of 0.20 or more in the specific gravity of the individual samples used in the blend. This also applies to the final gradation if a difference between the coarse and fine fraction is 0.20 or more.

   To make this correction for specific gravity, design the mix first in the usual manner without regard for the specific gravities of the aggregates. This will give the desired by-mass grading. To obtain the percent by volume, follow the procedure in the "C" portion of California Test 105.

g. The cumulative mass required for the 1000 g and 1200 g specimens normally used are derived by multiplying cumulative percent as used (from the grading of the aggregate) by 10 or

12 for the 1000 g or 1200 g sample, respectively. In cases when adjustment of the grading is necessary, the cumulative mass is based on the adjusted grading.

An example of the computation required is shown below:

Sieve Size, mm	Percent Passing
25.0	100
19.0	89
9.5	78
4.75	67

The cumulative mass for the samples are obtained as follows:

Pass	Ret.	1000 g Sample	1200 g Sample
25.0	19.0	(100-89) X 10 = 110	(100-89) X 12 = 132
19.0	9.5	(100-78) X 10 = 220	(100-78) X 12 = 264
9.5	4.75	(100-67) X 10 = 330	(100-67) X 12 = 396
4.75		(100-0) X 10 = 1000	(100-0) X 12 = 1200

The use of cumulative mass is considered the preferable method of combining the various size components of aggregates for bituminous mix tests; however, the individual increments may be weighed separately and combined if desired.

h. The material that is weighed out for the test specimens shall be free from moisture. Thoroughly quarter the passing 4.75 mm sample portion, and place it in pans approximately 250 mm in diameter by 50 mm deep. Do not add the passing 4.75 mm material from the sample sack without quartering or splitting as segregation may occur.

The dry mass of the aggregate for the swell specimen shall always be 1000 g. Normally, a 1200 g dry mass is sufficient for the stabilometer specimen. However, if the average specific gravity of the aggregate is 2.80 or higher, a 1300 g dry mass is generally required for the stabilometer specimen. Use the computed mass to prepare the specimens. Normally the number of specimens required per set consists of two for the swell test, four for the stabilometer test, and two for the MVS test. Weigh all material to the nearest gram.

i. Proportioning aggregate for centrifuge kerosene equivalent (CKE) test (California Test 303).

(1) Passing 4.75 mm material for determination of K_f. Assume that samples A, B, and C are to be combined.

Let:

a = Percent passing 4.75 mm for Sample A

b = Percent passing 4.75 mm for Sample B

c = Percent passing 4.75 mm for Sample C

Then the mass in grams of passing 4.75 mm material for each sample needed to give a total representative sample of 100 g is determined by the following formulas:

$$Xa = [a/(a+b+c)] \times 100$$

$$Xb = [b/(a+b+c)] \times 100$$

$$Xc = [c/(a+b+c)] \times 100$$

If it is desired to have extra material, as for instance, 5 g to allow for loss of weight in drying, then substitute 105 for 100 in the above formulas.

(2) Coarse material for determination of K_c. Determine the percent of pass 9.5 mm, retained 4.75 mm material for each sample and combine as above.

2. Bitumen

a. Use bitumen that is proposed for the project (both grade and source).
b. Determine "K" values. Refer to California Test 303, "Centrifuge Kerosene Equivalent."

c. Determine the approximate bitumen ratio. Refer to Figure 4, "Approximate Bitumen Ratio," of California Test 303.

d. On nonabsorptive material, four stabilometer specimens are sufficient for evaluating a sample. General practice is to prepare one specimen with the amount of asphalt as determined by the CKE test, two above CKE, in 0.5 % increments, and one 0.5 % below the CKE amount. The 0.5 % increment is satisfactory for the majority of samples; however, for extremely critical mixtures, the increments should be lowered to 0.3 % and the number of specimens increased to five. For highly absorptive, noncritical mixes, increase the increment to 1.0 % and use more specimens as necessary. In any case, the test series should have at least one specimen with an excess of asphalt as manifested by moderate or heavy flushing after compaction.

e. Refer to California Test 367 and establish the Optimum Bitumen Content (OBC).

f. Prepare the swell and moisture vapor susceptibility test specimens in duplicate using the OBC.

g. For open graded mixtures, prepare a 1000 g sample for inspection, using the bitumen content obtained from California Test 368.

3. Mixing and Curing

a. Preheat the aggregate if necessary to comply with temperatures listed in C, "Mixing." Add the proper amount of asphalt to the aggregate (e.g., OBC - 0.5 %, OBC, OBC + 0.5 %, etc.).

b. The mixing may then be performed by one of the following two methods:

(1) Transfer the mixture to a suitable pan, and place pan on a hot plate to maintain the mixing temperature. Hand mix vigorously with a small pointed trowel until all particles are coated. Mix aggregates that do not require preheating at the lowest possible temperature.

(2) Where the volume of work necessitates mass production methods, a mechanically operated mixer may be preferred.

c. When mixing is completed, transfer the mix to a suitable flat pan, approximately 280 by 180 by 25 mm and cure at a temperature of 60 ± 3˚C in an oven equipped with air circulation for 15 to 18 h.

d. The mixture is then ready for the compaction procedure as described in Part 2.

4. Samples in which aggregate larger than 25 mm is to be used in mixture.

a. Preliminary or design samples.

(1) Design the grading to conform to the specified limits.

(2) Calculate the surface area and perform the CKE test in accordance with California Test 303.

(3) In preparing test samples prior to adding the asphalt binder, use the entire grading up to and including the maximum size specified.

(4) Mix the amount of asphalt indicated by the CKE test with a specimen and provide additional specimens covering the range above the below the amount determined by the CKE test in 0.5% increments.

(5) Cure the mixtures in the normal manner.

(6) For the swell, stabilometer and MVS tests, screen the test sample through a 25 mm sieve and discard all retained material. The mass of the total test sample prior to screening on the 25 mm sieve should be sufficient to provide enough minus 25 mm material to form the usual 63.5 mm high briquette for the stabilometer test. Base the final recommended asphalt content for the entire mixture to be used on the project on the results and information furnished by the tests performed on the minus 25 mm portion of the mixture. Do not attempt to make allowances for the retained 25 mm portion.

(7) For the specific gravity test, use the entire grading. Batch enough material to obtain 152 mm diameter by 100 mm high specimens.

B. PREPARATION OF FIELD SAMPLES

1. For samples of uncompacted dense-graded asphalt concrete with a paving grade asphalt, heat the sample to approximately 95°C for workability. Thoroughly mix and quarter the sample, either by mechanical or hand quartering method, into amounts needed for the following tests:

1-Stabilometer	1200 - 1400 g
1-Moisture Vapor Susceptibility	1200 - 1400 g
1-Swell	1100 g
1-Extraction (California Test 310)	650 - 800 g
3-Surface Abrasions	1100 g each

Place the material for the above tests that require compaction (the extraction samples may be immediately placed in the extraction thimble and tested) in suitable flat pans, approximately 280 by 180 by 25 mm, and cure at 60 ± 3˚C for a minimum period of 15 h in an oven with provision for air circulation. The samples are then ready for compaction as described in Part 2.

2. Samples of uncompacted dense-graded asphalt concrete with liquid asphalt should be received in a sealed container. DO NOT HEAT. Thoroughly mix and quarter the sample either by mechanical or hand quartering method into the amounts needed for the following tests:

2-Stabilometer	1200 - 1400 g each
1-Moisture Vapor Susceptibility	1200 - 1400 g
1-Swell	1100 g
1-Extraction (California Test 310)	650 - 800 g
1-Moisture	500 g

Immediately place one stabilometer sample and a moisture sample in separate sealed containers until ready for testing, then test without curing or additional processing. Place the material for the remaining tests that require compaction in suitable approximately 280 by 180 by 25 mm flat pans (the extraction sample may be placed immediately in an extraction thimble and tested) and cure at 60 ± 3˚C for a minimum period of 15 h in an oven with provision for air circulation. The samples are then ready for compaction. Report data from both “as received” (uncured) specimens, and cured specimens, on the same report.

3. Samples of uncompacted dense-graded asphalt concrete with aggregate larger than 25 mm.

a. Quarter the sample and prepare test specimens in accordance with instructions above relating to type of asphalt used in the mixture. Prepare a 2000-g extraction sample and a 2700 g specific gravity sample.

b. After quartering, screen through a 25 mm sieve and use only the passing portion for all tests except the extraction and specific gravity tests.

c. Be sure that the samples for extraction and sieve analysis and for specific gravity are representative of the complete mixture as placed in the roadway.

d. Divide the 2000-g extraction sample into three approximately equal parts for the test (California Test 310).

e. After extracting the three portions, calculate the asphalt content based upon the mass for the total sample as one asphalt content.

4. Samples of compacted dense-graded asphalt concrete. Compacted samples usually consist of 200 by 200 mm slabs or 101.6 mm diameter cores that have been cut from the pavement. Compacted samples to be tested for stability or specific gravity should be shipped and stored on a sand bed to maintain integrity prior to testing. They should be dried at 38°C for 48 to 72 h before obtaining a specific gravity determination.

   a. Slabs: Saw the slab to obtain a 1000 to 3000 g mass for the specific gravity test.

      Do not cut the sample with a chisel as this may alter the integrity and provide an erroneous value.

      To minimize the effects of the sawn sample on the grading, heat a substantial mass to 110 ± 10°C and split or quarter this material to obtain 650 to 800 g for an extraction and sieve analysis.

   b. Cores: Cores 101.6 mm in diameter may be tested at 60°C or lesser temperatures for stability. Temperatures exceeding 60°C, however, may cause damage to the core and should be avoided. For cores in excess of 63.5 mm in height, trim the core with a diamond saw to a 63.5 mm height for the stabilometer test. Use plaster of Paris to cap and patch obvious surface irregularities in the core before testing for stability.

PART 2. METHOD OF COMPACTING BITUMINOUS MATERIALS FOR SWELL, STABILITY, MOISTURE VAPOR SUSCEPTIBILITY AND SPECIFIC GRAVITY TESTS.

A. APPARATUS

1. Mechanical compactor, as shown in Figure 3, designed to consolidate the material by a series of individual or roving "kneading action" impressions made by a ram having a face shaped as a sector of a 101.6 mm diameter circle. The compactor must be capable of exerting a force of 7120 N (3.45 MPa pressure by the tamper foot).

2. Compactor accessories: 101.6 ± 0.13 mm inside diameter by 127 ± 2 mm-high steel molds, a mold holder, and 101 ± 1 mm diameter cardboard disks.

3. Testing machine, 220 kN capacity.

4. Metal followers (two): one 101.2 ± 0.13 mm outside diameter by 140 ± 6 mm high, and the other ram 101.2 ± 0.13 mm outside diameter by 40 ± 6 mm high.

5. Two ovens to maintain temperatures of 60 ± 3°C and 110 ± 5°C, respectively.

6. Mechanical spader (optional), designed to prevent segregation of coarse and fine material or the formation of rock pockets in the test specimen by introducing the mixture into the compaction mold from an endless belt at the same time imparting a spading action with four mechanically operated 12.7 mm diameter by 580 mm-long, bullet-nosed steel rods. See Figure 4.

7. Special feeder trough, 100 mm wide and 400 mm long, that may be used in lieu of the mechanical spader. See Figure 5.

8. Flat metal scoop, approximately 250 by 360 mm.

9. 12.5 mm sieve.

10. Special pressing standard for applying aluminum seal caps. See Figure 6. (Dimensions shown are in mm.)

11. Aluminum seal caps, 100.0 ± 0.5 mm diameter by approximately 1 mm thick.

12. Balance, 2000-g capacity, 1 g accuracy.

13. Suitable device for measuring height of test specimens to the nearest 0.1 mm.

14. Metal disc, 100 ± 1 mm diameter by 12 mm thick minimum. (For asphalt rubber specimens only.)

For large stone mixes, the following apparatus will be required:

1. Tamper foot, approximately 3.48 x 10^{-3} m^2.

2. Compaction molds, 152.4 ± 1 mm diameter by 203 ± 1 mm high.

3. Pressing ram, 151 ± 1 mm diameter by 127 ± 5 mm.

4. Mold holder.

5. 152 mm specimen extractor.

6. Mechanical compactor, capable of exerting a force of 12 kN (3.45 MPa pressure by the tamper foot).

B. FABRICATION

1. Swell test specimen.

   a. Prepare the mold by placing a paraffin impregnated strip of ordinary wrapping paper 19 mm wide around the inside of the mold, so that the bottom of the strip is 12 to 19 mm from the bottom of the mold. Dip the paper strip in hot paraffin and apply while hot to the inside of the room temperature mold.

   b. Place the mold in the mold holder. Put this unit into position in the mechanical spader. (If a mechanical spader is not available, proceed to paragraph "h"). Place a metal shim 6 mm thick, approximately 19 mm wide by 65 mm long under the mold adjacent to the portion of the mold holder that extends up into the mold. Place the 100 mm diameter cardboard disk into the mold on top of the mold holder base.

   c. Weigh out 1000 ± 1 g of mix that has been brought to the proper compaction temperature:

      60 ± 3°C for mixtures containing liquid grade asphalt.

      110 ± 5°C for mixtures containing paving grade asphalt.

      Room temperature for mixtures containing liquid grade asphalts when it is desired to test with whatever moisture may be present in the sample.

   d. Separate the coarse and fine material by screening the mix through a 12.5 mm sieve onto the flat metal scoop.

   e. Arrange the separated material into two parallel rows across the width of the scoop.

   f. Slide the mix onto the feeder belt of the mechanical spader, exercising care so as not to disturb the size arrangement affected on the metal scoop.

   g. Start the mechanical spader and distribute <u>all</u> of the material into the compaction mold.

   h. In lieu of the mechanical spader described above, a specially constructed feeder trough, approximately 100 mm wide by 400 mm long, may be used to place the mix into the mold. See Figure 5. Thoroughly mix and disperse the heated material on the trough (which has also been

preheated to approximately the compaction temperature to be used) to ensure a uniform sample when transferred to the mold. Place the mold in position in the mold holder and place a 100 mm diameter cardboard disc into the mold on top of the mold holder base.

Use a paddle, shaped to fit the trough, to push one half of the material into the mold. Rod the material 20 times in the center of the mass and 20 times around the edge with a bullet-nosed steel rod 9.5 mm in diameter, by 400 mm long. Then, push the remainder of the sample into the mold and repeat the rodding procedure just penetrating the first lift. Perform these operations as rapidly as possible to prevent cooling of the sample. If two feeder troughs and two mold holders are available, the work can be expedited by preparing another sample while one is being compacted. The extra trough containing the sample is kept in the oven until ready for compaction.

i. Place the mold holder containing the mix and the mold into position in the mechanical compactor.

j. Start the compactor and adjust the air pressure to a point where 1.7 MPa will be exerted by the tamper foot. Keep the tamper foot hot enough to prevent the mix from adhering to it.

k. Apply approximately 20 tamping blows at 1.7 MPa to accomplish a semi-compacted condition of the mix so it will not be unduly disturbed when the full load is applied. The exact number of blows to accomplish the semi-compaction shall be determined by observation. The number of blows may vary between 10 and 50, depending upon the type of material, and in some instances where sandy or unstable material is to be compacted, it may not be possible to accomplish the compaction in the mechanical compactor because of excessive movement of the mixture under the compactor foot. In these instances, apply a 178 kN compression load at a speed of 6.35 ± 0.02 mm/min by the double plunger method, in which a free-fitting plunger is placed below the sample as well as on top, to complete the compaction. When compacting the first specimen of a set, which is normally one of the swell test specimens, if it is found that the material will not consolidate under the full tamper load, subject the remaining specimens in the set to a 178 kN compression load only.[1]

l. Remove the 6 mm shim and release the tightening screw sufficiently to allow approximately 3 mm lateral side movement during the compaction stroke. Then raise the compaction pressure to 3.4 MPa and apply 150 tamping blows to complete the compaction in the mechanical compactor.

m. Remove the mold and specimen from the compactor and push the test specimen to the opposite end of the compaction mold. This is done to provide water contact to the face of the specimen that has not been in contact with the compactor foot for the swell test.

n. Apply a leveling-off load of 56 kN in the testing machine[1] at a head speed of 6.4 ± 0.05 mm/min with the bottom of the sample in contact with the lower platen of the press. Release the applied load immediately.

o. Measure the height of the test specimen to the nearest 0.1 mm and record for later use.

p. Let the compacted swell specimens remain at room temperature for

[1] If the testing machine had a spherically seated type of upper head, use the proper shims to lock it in such a manner that the contact face is fixed firmly in a horizontal plane.

approximately 1 h prior to the start of the swell test.

q. Test according to California Test 305.

2. Stability test specimen. The steps used in the fabrication of these test specimens are the same as for the swell test specimen except for the following variations:

a. Use the amount of mix required to produce a test specimen 63.5 mm high. This amount may be calculated from the height that was recorded for the 1000 g of material used for the swell test specimen by the following formula:

$(X / 63.5) = 1000 / H$
or
$X = (63\,500 / H)$

Where:

X = Mass of mix in grams to give a 63.5 mm-high specimen

H = Height in mm of the 1000 g swell specimen

Example:

If 1000 g of mix gives a height of 55.8 mm, what mass will be needed for a 63.5 mm high specimen?

$X = (63\,500 / 55.8) = 1138$ g

b. Preheat the compaction molds and feeder trough to approximately the compaction temperature specified under Part 2, B.1.c. [150 ± 5°C for mixtures containing asphalt rubber]. Paraffin strips are not used.

c. After compaction in the mechanical compactor, place the asphalt rubber specimens on the metal disc to prevent distortion while cooling in the 60°C oven. Place the bituminous mix specimens in the 60°C oven for the following minimum length of time prior to applying a 56 kN leveling-off load:

1 h if compacted at 60°C
1-1 / 2 h if compacted at 110°C
2 h if compacted at 150°C

Do not push the specimens to the opposite end of mold as is done in the swell test.

d. Apply the 56 kN leveling-off load[1] by the double plunger method in which a free-fitting plunger is placed below the sample as well as on top. Measure the height of specimen to the nearest 0.1 mm, record the measurement, and return the specimen to the 60°C oven to retain temperature for testing.

e. Compact road-mixed asphalt concrete samples at room temperature to retain the moisture present. Select a time so that the stability test may be performed immediately following compaction. If the stability test value is below the specified value, repeat the test on a moisture-free sample compacted at 60°C.

3. Moisture Vapor Susceptibility (MVS) test specimen.

a. Fabricate the MVS test specimen the same as the stability test specimen with the following variations:

After heating as specified in paragraph 2c, invert the mold and place on the MVS pressing standard, as shown in Figure 6. Press the specimen down through the mold until it seats on the pressing standard. Apply a 56 kN leveling off load[1].

b. Test according to California Test 307.

4. Specific Gravity test specimen.

a. The specimens tested for stability are used to obtain specific gravities.

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[1] If the testing machine has a spherically seated type of upper head, use the proper shims to lock it in such a manner that the contact face is fixed firmly in a horizontal plane.

b. Large stone mixes.

(1) Using past experience and/or height to mass ratios, determine the mass needed to obtain a 152 mm diameter by 100 mm high specimen.

(2) Split the heated material into three equal portions.

(3) Heat the mix and molds to 110 ± 5°C.

(4) Place the mold in the mold holder on a 6 mm shim and insert a 151 ± 1 mm diameter cardboard disc into the mold on top of the mold holder base.

(5) Place one portion of the mix into the mold and systematically rod the material 35 times with a bullet-nosed steel rod 9.5 ± 1 mm in diameter, approximately 400 mm long.

(6) Place the remaining two portions into the mold at 110 ± 5°C, rodding each portion 35 times to a depth that just penetrates the previous layer. Perform these operations as rapidly as possible.

(7) Place the mix assembly into position in the mechanical compactor.

(8) Compact the sample according to Part 2, B.1.j, k and l with the following changes:

(a) If movement of the mixture is excessive for compaction by the compactor, reject this mix design. Do not apply a compression load using the testing machine.

(b) After removing the 6 mm shim and releasing the tightening screw, raise the compaction pressure to 2.7 MPa instead of 3.4 MPa and apply 150 blows.

(9) Remove the mold from the mold holder, insert the pressing ram and immediately apply a 125.8 kN leveling load to the specimen.

(10) Allow the specimen to cool to room temperature and push it from the mold.

(11) Observe and report any evidence of flushing on the compacted surface.

(12) Test according to California Test 308, Method A.

C. PRECAUTIONS

1. To ensure proper particle orientation in the test specimen, it is quite important that the operator exercise particular care in placing the mix on the feeder belt of the mechanical spader or feeder trough. Indiscriminate screening and placing of the mix may produce test specimens having considerable segregation of the aggregate with resulting inaccurate test results.

2. The compaction pressure shall be maintained in accordance with the Method of Operation and Calibration of the Mechanical Compactor; see California Test 101.

3. Compaction temperatures shall be carefully controlled.

4. Periodically check the 101.6 mm diameter molds. Do not use molds that become elliptical in excess of 101.6 ± 0.25 mm for stabilometer specimens.

REFERENCES:

California Tests 101, 105, 201, 202, 303, 305, 307, 308, 310, 360, 366, 367, and 368
ASTM Designation: D-1561

End of Text (California Test 304 contains 16 pages)

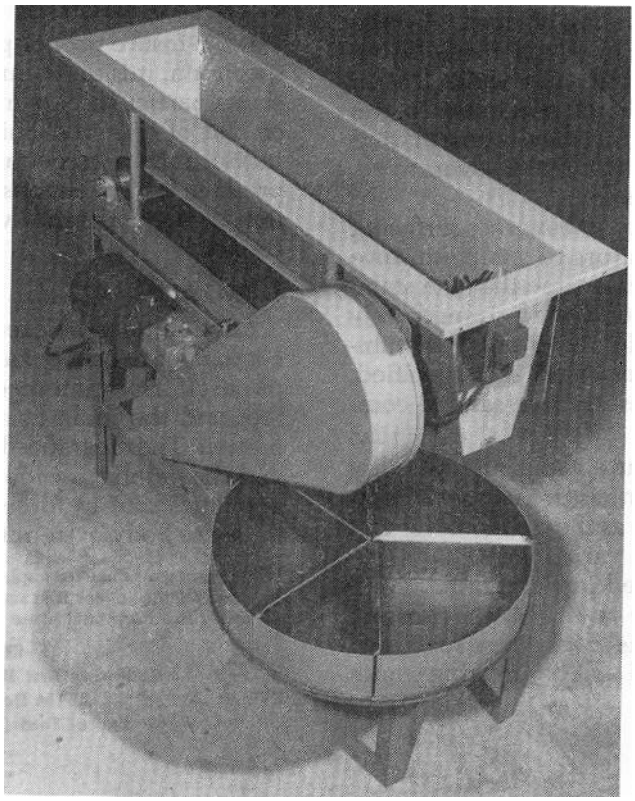


FIGURE 1

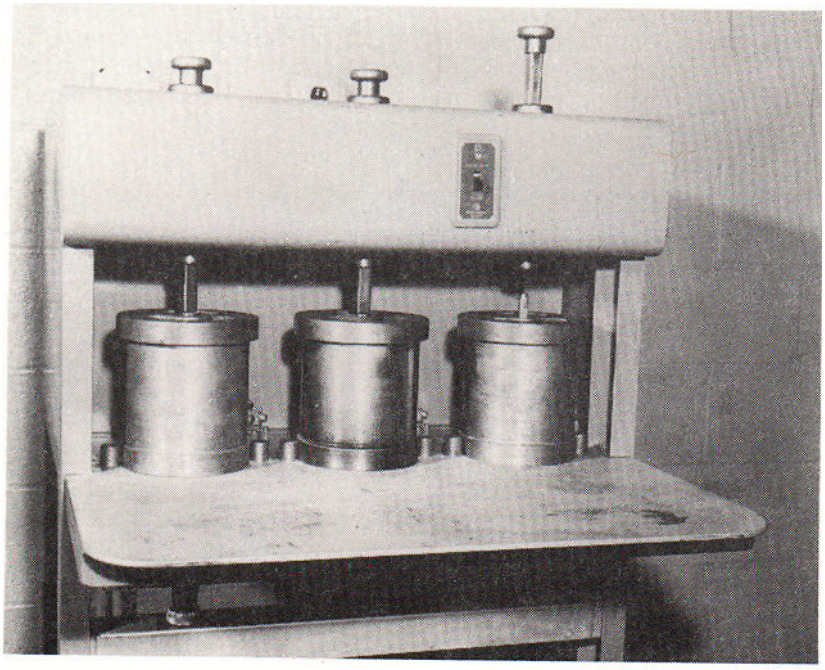


FIGURE 2

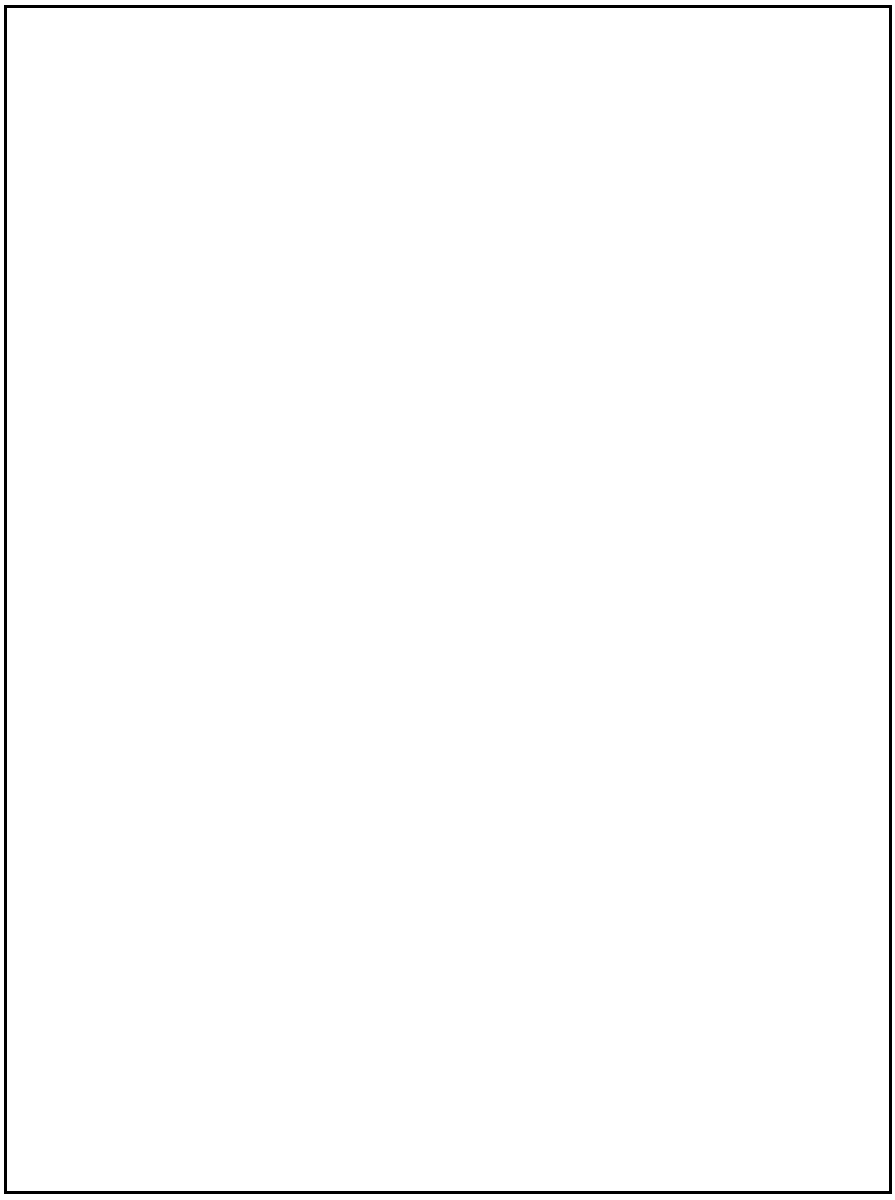


FIGURE 3

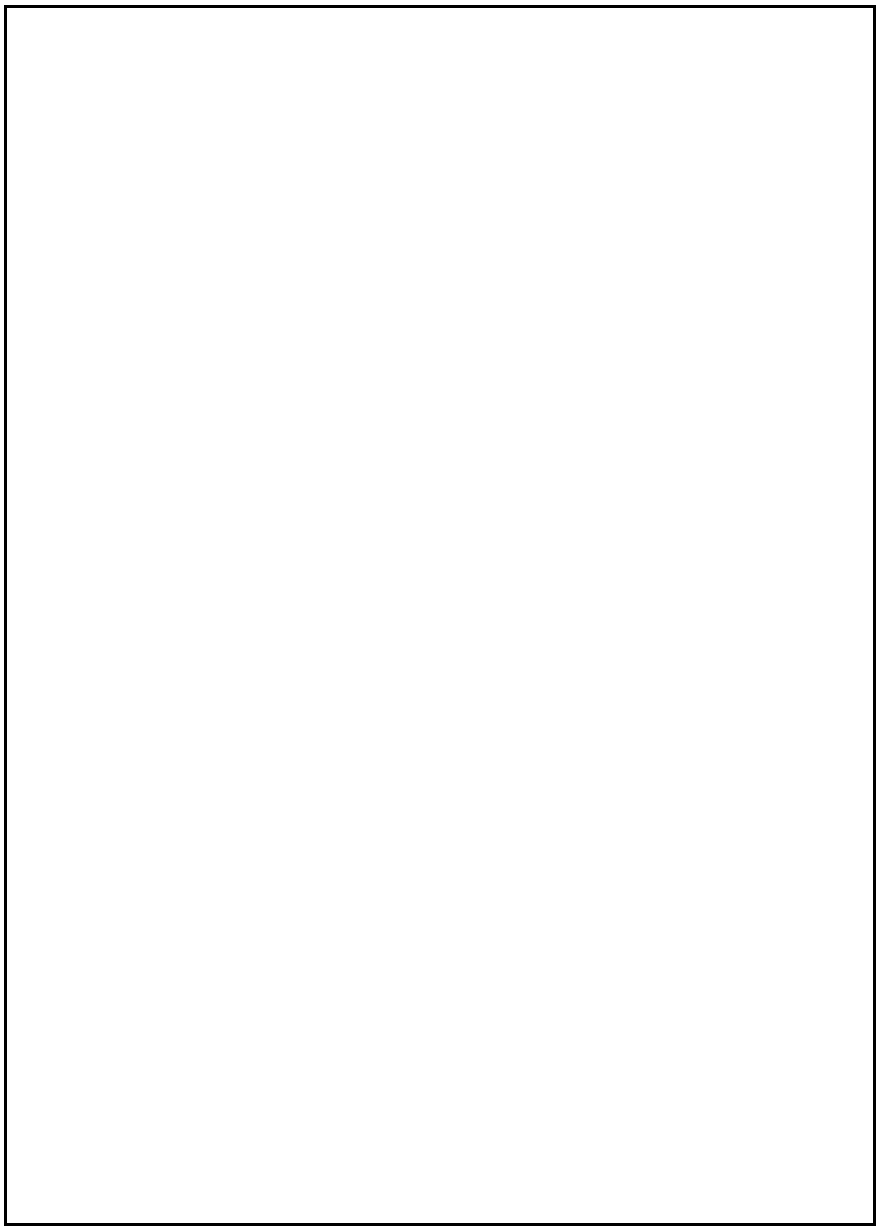


FIGURE 4

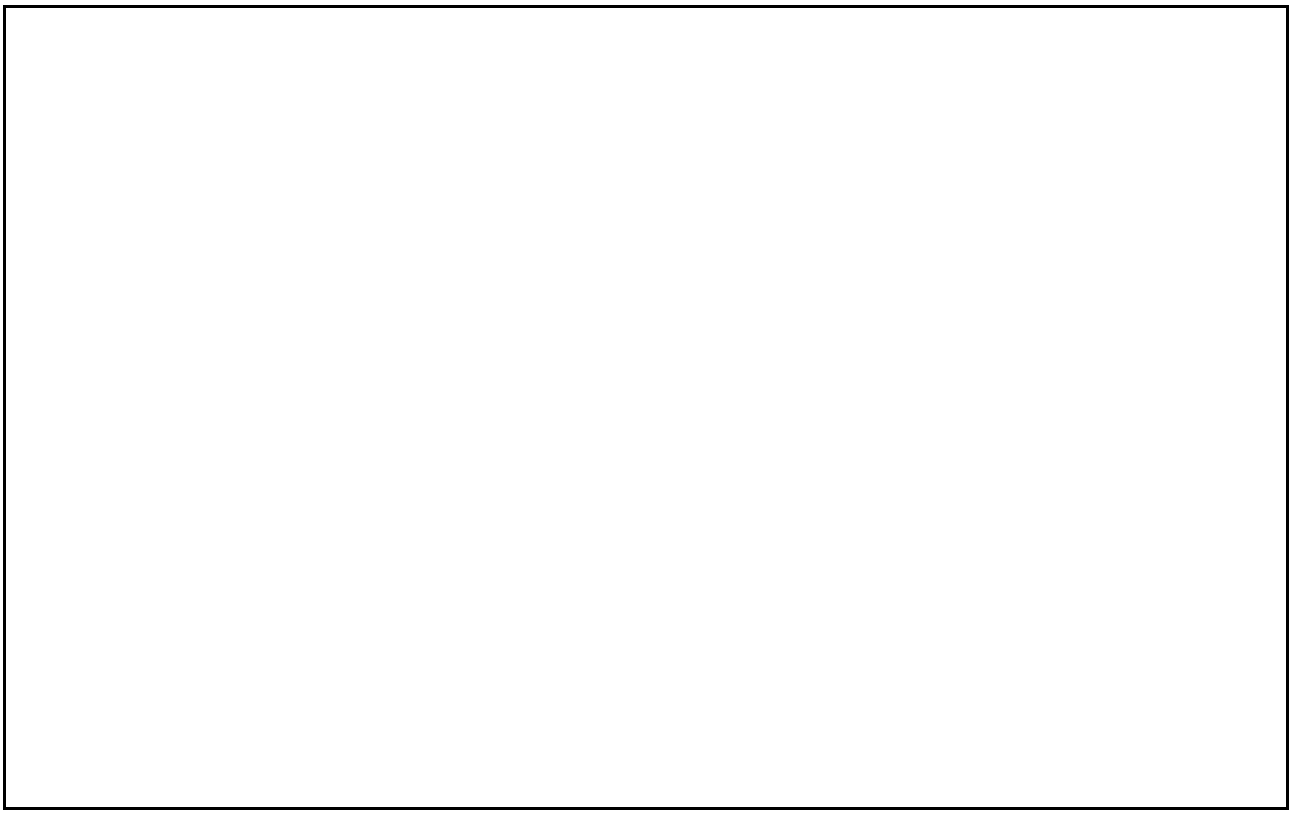
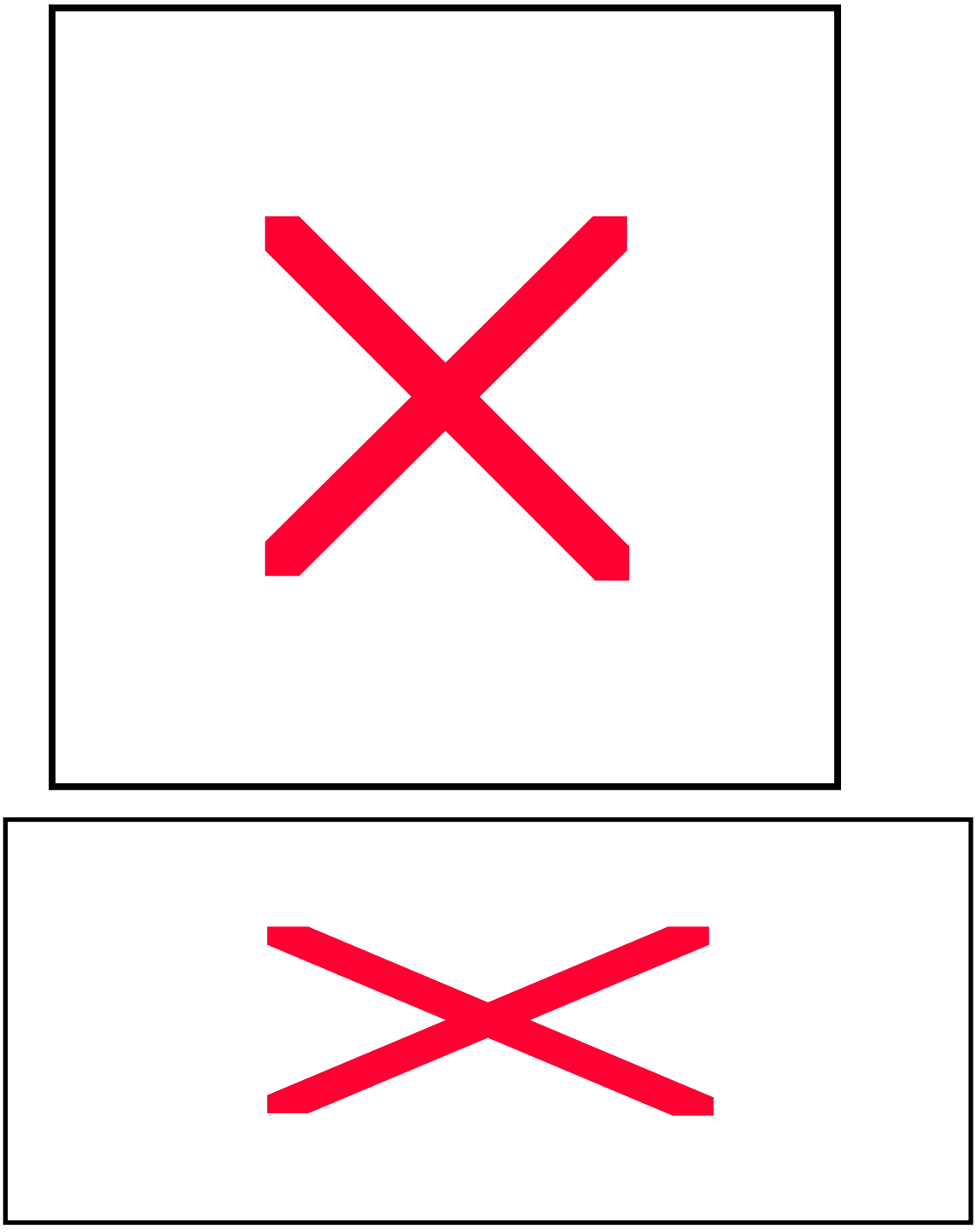


FIGURE 5



M.V.S. PRESSING STANDARD
(All dimensions ± 2 mm, except as noted.)

FIGURE 6